AGRICULTURAL
Research

U.S. DEPARTMENT OF AGRICULTURE

DECEMBER 1963

Barring Our Doors Against Plant Pests Page 8

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DECEMBER 1963/VOL. 12, NO. 6

Inspector P.Q.

The second largest shipment of pure heroin ever intercepted in the United States was stopped last October at the Mexican border by an alert ARS plant quarantine inspector while making a routine auto search (see page 16 of this issue).

Important as this seizure was, however, such bonus actions must take a backseat to the routine daily plant pest interceptions that usually receive no fanfare. ARS inspectors intercept an average of one plant pest every 16 minutes—around the clock (see page 8).

In the last decade, these inspectors have prevented nearly a quarter of a million insects, diseases, nematodes, mites, and snails from entering the United States.

Their actions safeguard the productive ability of U.S. agriculture. Without plant quarantine inspectors, Americans might not be the best fed and the best clothed people in the world. Without these inspectors, one American farmer could not produce enough for himself and 28 fellow Americans.

A New Orleans inspector who intercepted two pupae of a large European white butterfly on a shipment from Greece helped protect cabbage and cotton crops in this country. The insect causes serious damage to cabbage in Europe and Asia and to cotton in the Soviet Union.

By keeping the European butterfly out, he contributed equally with the research scientist who is helping develop dramatic new approaches to control and eradication of insects that are established here.

Plant Quarantine Inspector John Gayden of California, a colonel in the U.S. Air Force Reserve, puts it this way: "When the average American thinks about America's strength, he thinks in terms of military or industrial might and capacity. Actually, our greatest strength, the thing Mr. Khrushchev really envies, is our agricultural production. . . . My job is to protect this agriculture."

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Editor: R. E. Enlow.
Contributors to this issue:
V. R. Bourdette, W. E. Carnahan,
E. J. Fitzgerald, D. W. Goodman,
M. E. Haun, R. P. Kaniuka,
W. W. Martin, H. H. Smith.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington, D.C., 20402. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C., 20402.

Orville L. Freeman, Secretary,
U.S. Department of Agriculture

B. T. Shaw, Administrator,
Agricultural Research Service

ARS mass produces experimental viruses as . . .

LIVING INSECTICIDES

That attack only the cabbage looper and corn earworm

■ Living insecticides containing viruses that in nature infect and kill two destructive insect pests—the cabbage looper and the corn earworm—have been mass produced and successfully used to spray test crops.

Laboratory and field experiments conducted by the Agricultural Research Service indicate that these two viruses are safe and reliable biological controls. Research has established these important points:

- Both of these experimental viruses are highly specific. One infects only the cabbage looper. The other infects the corn earworm and possibly the closely related tobacco budworm.
- Both viruses are regarded as harmless to man, animals, plants, and pollinating insects, as well as to other natural enemies of each target pest.
- Objectionable residues are not left on treated crops; in fact, infective forms of the viruses occur naturally on crops attacked by these two pests.

Although natural virus infections occur frequently, they do not always provide control at the right time. Even when a natural infection eventually eliminates a high insect population, the epidemic phase of the disease may not have come until after the crop is seriously damaged. In their tests with mass-produced viruses, ARS entomologists were able to create epidemics that brought the insects under control before they could damage crops.

The cabbage looper and corn earworm, two of the most widespread and destructive insect pests in the United States, annually damage or destroy crops worth several hundred million dollars. The corn earworm, which likes a varied diet, is also known as the cotton bollworm when it feeds on cotton. Only the boll weevil destroys more cotton in this country.

ARS scientists say that basic studies on insect-rearing methods and on ways to culture and produce the viruses have made it possible to eventually produce and sell

Sequence photos show how virus infects and kills cabbage looper. From top: healthy looper; advanced stage of disease; dead looper; ruptured body wall, which has dispersed virus-laden polyhedra to resume infective cycle.

Clusters of the virus that attacks the cabbage looper are protected by a coating of protein forming many-sided bodies called polyhedra (left). Walls of polyhedra (right) have been partially dissolved to show the rod-shaped virus particles inside.

LIVING INSECTICIDES *(Continued)*

viruses at prices farmers can afford. Several firms are already interested in producing the viruses, and uniform standards are being developed for commercial production. However, the virus insecticides are still in an experimental stage; they have not yet been approved for public use.

Current research on the viruses is aimed at getting more information on the optimum time, rate, and frequency of application. More data is being collected on their effectiveness; so far, preliminary tests show that they compare favorably with available insecticides for controlling the looper and the earworm. Viruses are not as fast-acting as insecticides—a disadvantage if heavy insect populations are allowed to build up before treatment. However, entomologists believe this can be remedied by properly timed preventive treatments, perhaps combining the viruses with fast-killing organisms now under study.

ARS also reports encouraging progress in developing techniques to produce and use at least 10 of the 200 known viruses that attack specific insect species. These studies were initiated after decisions were made in the mid-1950's to focus more research on this aspect of biological control.

Both the cabbage looper and the corn earworm can be infected by what scientists call a nuclear polyhedral virus that develops in the nucleus of infected cells. Once a virus infects the cells of its host insect, the cells produce virus instead of carrying on their normal functions. During this process, virus particles cluster under a protective covering of protein and form a polyhedron (a many-sided body), which is tough and durable and can live in the soil for years.

Scientists in this country and abroad have long been aware of the great potential of viruses in biological insect control; the University of California, for example, has emphasized research on insect pathogens in recent years. However, it was not possible to exploit this opportunity because there was no known way of mass producing the virus polyhedra economically. ARS scientists have been conducting basic studies on the cabbage looper and corn earworm viruses for 5 years, and the breakthrough came when they worked out a method of artificially rearing large numbers of the insects—in whose bodies the polyhedra must develop.

To mass produce the virus materials, the scientists infect the artificially reared worms by feeding them virus polyhedra. These multiply rapidly in the infected worms, then are extracted and processed for field use.

Polyhedra multiply at a fantastic rate. Estimates are that one artificially reared cabbage looper can produce nearly $2\frac{1}{2}$ billion polyhedra. A man could probably hold enough powdered cabbage looper virus on the nail of his little finger to treat 5 acres. Processed virus, depending on how prepared, may be in either liquid or powder form. Because polyhedra are durable, they pose no difficult problems in handling or applying them.

Once the virus is on the crop and consumed by the target insect, the insect in turn becomes a virus producer. The process is the same in both native and artificially reared insects. Infected worms become literally loaded with polyhedra, which are dispersed when the worm dies and its body decomposes. Under some field conditions, these artificially induced infections may build up enough virus to infect subsequent generations of the insect.

Natural dispersal of polyhedra, however, is not sufficiently reliable to assure dependable insect control. The small, heavy particles usually settle into the soil, away from feeding worms. Consequently, repeat applications of artificially produced polyhedra may be necessary to insure adequate seasonlong crop protection.☆

How Hot Should An Iron Be?

Household equipment specialists determine ironing temperatures that keep modern fabrics long lasting and looking their best

■ What temperature should a hand iron be to remove wrinkles but not discolor or weaken a fabric excessively?

The development of synthetic fibers has complicated this question for iron manufacturers, who need to know all the correct answers so they can give proper instructions to users of their appliances. They now have some of the answers from the Beltsville Housing and Equipment Laboratory.

Derived settings for 12 fabrics

Household equipment specialists Enid Sater Ross and Katherine Taube of ARS determined safe and effective temperatures for ironing fabrics of 8 widely used synthetic fibers and 4 natural fibers. These temperatures were worked out by ironing each fabric under a wide range of temperatures, beginning with a high setting—400° F. or higher—then decreasing it at 25-degree intervals.

Judges evaluated samples

The scientists noted any undesirable changes such as puckering, shrinking, stiffening, sticking to the iron, and change in color. Then a panel of judges evaluated the samples for smoothness. Repeated ironing at different temperatures was followed by color measurements and by tearing-strength measurements to assess fabric damage.

Following is a list of the lowest temperatures producing satisfactorily ironed fabrics of the various fibers, which had been given no special finishes. These are recommended as the starting points in ironing.

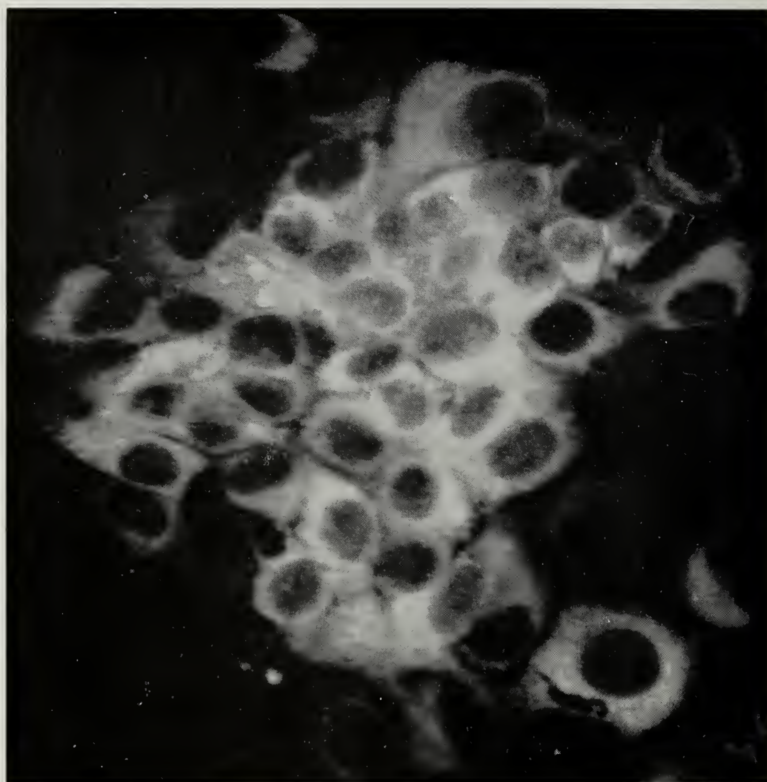
Degrees F.	*Fabric*
225	Modacrylic
250	Acrylic; Dacron polyester
275	Triacetate
300	Wool; acetate; nylon
325	Kodel polyester; rayon; silk
350	Cotton; linen

If these temperatures do not give satisfactory smoothness, try more heat, the researchers suggest. (A fast fabric worker ironing a very damp fabric may use higher temperatures than a slow worker ironing a dry fabric.) The scientists found that increasing temperatures from 50 to 75 degrees did not injure most of the fabrics studied. Exceptions were modacrylic fabric, which could not be ironed above 250 degrees (only 25 degrees higher than the minimum listed), and acetate, nylon, and silk fabrics, which showed significant losses in tearing strength when ironed repeatedly, even at recommended temperatures.

Labels on present-day fabrics provide consumer information on fiber content. By knowing and using proper ironing temperatures, homemakers can protect the fabric's appearance. Appliance manufacturers who mark hand irons in accordance with scientific findings will help assure fabric protection. If a homemaker's iron has a thermostat that lacks some fiber names, she should make a note—mental or written—of these names and their proper ironing temperatures, the ARS researchers suggest.☆

Equipment specialist holds iron on thermocouple device (left) until exact test temperature is reached. Then she applies the iron to swatch of fabric being tested (right) and holds it there until predetermined time has elapsed.

A new and more rapid test for HOG CHOLERA



A "bright stained look" characterizes cells infected with hog cholera virus. Before microscopic examination, the cells are inoculated, then treated with fluorescent dye and anti-hog-cholera serum.

■ A rapid, accurate diagnostic test for hog cholera, a disease that costs producers $50 million a year, has been developed by ARS scientists at the National Animal Disease Laboratory, Ames, Iowa.

Here, briefly, is how it works: A culture containing tissue from a suspected hog is treated with a fluorescent dye that is in combination with anti-hog-cholera serum. Infected cells retain the dye-serum and are readily distinguished under a microscope from noninfected cells.

This relatively inexpensive and easily performed test, which must now be proved in the field, may be of great help to hog cholera research programs and the Federal-State hog cholera eradication program.

Symptoms of hog cholera vary, depending on the stage and acuteness of the disease, so that it may be confused with certain other hog diseases such as influenza, anthrax, necrotic enteritis, pneumonia, or erysipelas. Because of this complication, several diagnostic aids, as well as the study of clinical symptoms by veterinarians, must now frequently be used for positive diagnosis of cholera. The diagnostic aids include white blood cell counts, microscopic examination of brain tissue, and post mortems.

At present, the most reliable single test for hog cholera infection is made by inoculating healthy young pigs, some susceptible and some immune to hog cholera, with a sample of blood or tissue taken from hogs that are suspected of having cholera. If hog cholera virus is present in the suspected sample, the immune pig will remain healthy but the susceptible pig will either sicken and die or recover and be immune to future exposures to virulent hog cholera virus.

However, this inoculation test is expensive and may take several weeks to complete. These marked disadvantages preclude the widespread use of this test in the nationwide eradication program.

The new test, which takes less than a day, was developed by ARS scientists W. L. Mengeling, E. C. Pirtle, and J. P. Torrey. Using 51 experimentally infected hogs at the Ames laboratory, they were able to detect hog cholera virus in samples of blood,

serum, or spleen extracts from infected animals that had above-normal temperatures for at least two days.

Two cases emphasize the importance of proper timing. The scientists were unable to identify hog cholera virus in blood samples from two experimentally infected hogs in the early stage of infection. However, they did identify the virus in blood samples taken from these pigs after a temperature rise of two days' duration.

In one instance, hog cholera virus was not identified in a blood sample drawn from an animal in the disease's terminal stage after the temperature had dropped to normal, although two earlier blood samples showed the virus.

Kidney cells are kept ready

For this test, hog kidney cells are grown or cultured in the laboratory and kept ready for use. These cell cultures are inoculated with blood, serum, or spleen suspension from suspect hogs. The cultures are then incubated overnight, then washed, dried, and fixed in acetone.

The presence of hog cholera virus in the culture containing the suspected specimen is determined by using a combination of fluorescent dye and anti-hog-cholera serum.

When examined by microscope under ultraviolet light, the stained virus-infected cells are a bright yellow-green in contrast to noninfected cells, which have a pale green or brown background fluorescence. The dye is retained only by hog cholera viral antigen in the cytoplasm of infected cells.

The specific anti-hog-cholera serum used in this test is prepared from hogs raised in isolation and kept free from infectious agents other than hog cholera virus. These hogs are immunized and hyperimmunized with hog cholera virus to cause them to produce anti-hog-cholera serum.☆

For home gardeners . . .

A PORTABLE HOTBED

■ An inexpensive 6- by 6-foot portable hotbed, made of wood, metal tubing, and sheet plastic, has been designed for home gardeners by ARS horticulturist R.E. Wester.

The structure costs about $25 to build and weighs less than 50 pounds, making it easy to move to a suitable plot in the backyard. Wester's design includes a soil heating cable that cuts off automatically at 70 degrees F.

The frame consists of a wooden base constructed of pine boards and covered with a truss made of ½-inch electric conduit piping. Supporting pipes reach to a ridge pole, giving the whole structure the appearance of a tiny greenhouse.

The ends and sides are made of plastic film of 4-mil thickness. Side plastic sheets can be rolled down over the tubing frame to any desired height and held taut by cords. The side sheets are fastened to wooden strips so that they can be rolled up at the end of spring and stored in a basement to prevent summer heat damage.

In the fall, the side sheets can be put over the hotbed again to start or propagate plants during fall and winter.☆

Home gardeners can get all-year service from this newly designed hotbed. Through the summer it can be used to start cuttings; in the fall and winter it protects half-hardy and tender plants. Model shown is equipped with automatic spray valves to water shrub cuttings.

BARRING OUR DOORS AGAINST PLANT PESTS

■ Sixty bright red berries in a suitcase. Just a souvenir to show the folks back home, an air passenger thought. They were coffee berries from Brazil; they were pretty—and they were infested with the Mediterranean fruit fly.

The passenger who brought these berries meant no harm. He was not aware of quarantine regulations or of the reasons for them.

But not too long ago another traveler, at Laredo, Tex., obviously did know about the regulations. Inspectors found orchids stuffed into his pockets and tree seeds concealed in his money belt. Both the flowers and the seeds harbored dangerous plant pests.

Many of the plant pests that now cost Americans $7 billion a year in damage to crops and ornamentals have been carried here by ships and planes. Most of the serious ones came before the Quarantine Act of 1912. This Act gave USDA authority to inspect imported fruits and plants, apply treatments to remove pests, or prohibit unwanted plants and plant products from entering the country.

ARS inspectors are stationed at major U.S. airports, seaports, and border crossings to enforce the plant quarantines. Since 1953, these in-

Ships dock alongside grain elevators after coming to ports of entry laden with cargoes from countries infested by the khapra beetle. This pest is being intercepted by ARS at an average of 90 times a year.

spectors have made 230,747 interceptions of insects, diseases, nematodes, mites, and snails. These interceptions included many of the world's most important plant pests. The accompanying table lists a few of those regularly intercepted.

These hitchhiking pests came on fruits and shrubs, in dirt clinging to automobiles and plants, and in or on packing materials—but most of them were brought in passenger luggage.

No. of Interceptions, 1953–1963

Pest	Total
European cherry fruit fly	505
Mediterranean fruit fly	1,480
Melon fly	113
Mexican fruit fly	1,931
Olive fruit fly	379
Oriental fruit fly	276
West Indian fruit fly	1,493
Citrus blackfly	170
Durra stem borer	58
Khapra beetle	928
Mediterranean land snail	450
Pink bollworm	495
Japanese citrus scale	2,479
Cancrosis B	76
Citrus canker	1,473
Golden nematode	558
Sweet orange scab	1,113
Blackspot of citrus	2,223

During the fiscal year, ended June 30, 1963, ARS inspected 144,601 airplanes; 59,556 ships; 25,962,219 vehicles; and 66,010 railway cars. ARS also cooperated with Customs officials in examining 27,933,552 pieces of passenger luggage and with postal officials in examining 43,910,990 packages. They intercepted damaging plant pests 31,439 times and found 394,915 lots of prohibited plant material.

Increased foreign travel has intensified the threat from plant pests, but the problem is not new. Stem rust fungus came to Massachusetts from Europe before 1726. Another small-grain pest, the hessian fly, is said to have been brought to the United States during the Revolutionary War—in bedding carried by German soldiers hired by the British to fight the colonists. The insect spread westward and, along with stem rust fungus, contributed to the wheatless days during World War I.

Entomologists estimate that nearly 100 other species of economically important insects were introduced into this country during the half century preceding the Quarantine Act. These pests include the horn fly, asparagus beetle, gypsy moth, San Jose scale, European red mite, greenbug, Argentine ant, boll weevil, European corn borer, and alfalfa weevil. But during the half century since enforcement of the Act, only about 30 significant foreign insect pests have become established in the United States.

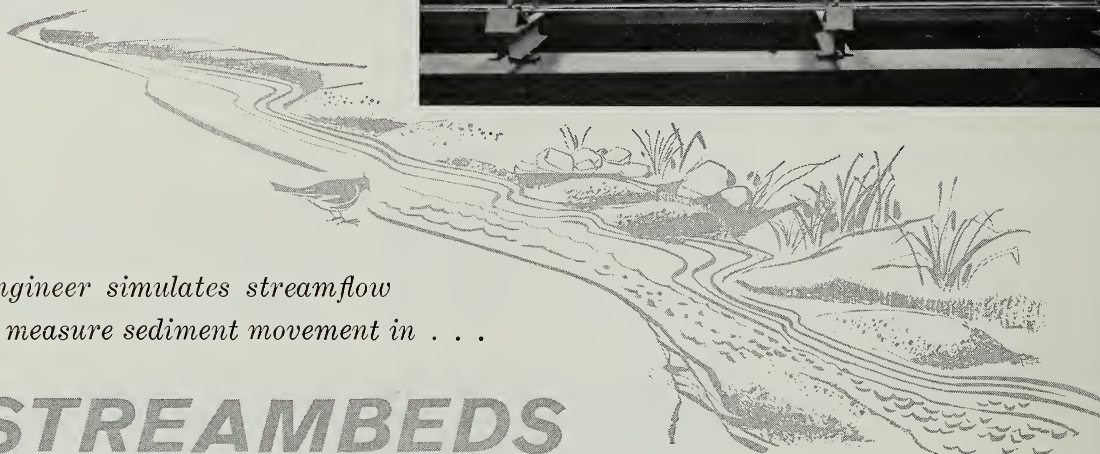
The Act does not prohibit importation of all plant material. Many plants and plant products may be imported for commercial or private purposes if a permit is first obtained from ARS. The quarantine regulations vary, depending on the plant material involved, the country of origin, and the plant pests that occur in that country.

Meanwhile, plant quarantine inspectors—vigilant around the clock—continue to stop an incoming plant pest on the average of once every 16 minutes throughout the year.☆

TOP—Each of the almost 30 million vehicles that came here from Mexico in 1963 was thoroughly checked by ARS and customs inspectors. BOTTOM—Working around the clock, ARS stops an inbound plant pest on the average of once every 16 minutes.

710-337°—63——2

Dotted line follows contour of dunes induced in this flume by varying the velocity and depth of the stream.



Engineer simulates streamflow to measure sediment movement in . . .

STREAMBEDS

■ An ARS engineer at the USDA Sedimentation Laboratory, Oxford, Miss., is making encouraging progress in developing a way of calculating how much sediment moves in continuous contact with a streambed.

Engineers need more accurate ways of predicting sediment movement so they can design channels that will carry the sediment without overflowing after heavy rains. They also need to know how sediment moves to estimate how rapidly it fills reservoirs. (See "What Sedimentation Is Doing," Agr. Res., September 1959, p. 8.)

May bounce, roll, slide

A stream carries sediment in three ways—suspended in the water, bouncing along the streambed (saltation), and rolling or sliding in continuous contact with the streambed (bed load). ARS hydraulic engineer R. A. Stein is studying the amount of bed-load material carried in streams moving at different velocities and depths. He is conducting his experiments in a 100-foot-long rectangular laboratory flume.

Stein explains that both the channel shape and configuration or contour of the channel bottom affect the bed load. He induced changes in channel bottom configuration by varying the stream velocity and depth. The channel bottom may be either extremely uneven or flat, depending upon how fast the water moves over it.

With low-velocity water flows, the streambed is a series of constantly moving, constantly changing sand dunes. Water moves these underwater dunes just as the wind continually shifts sand dunes on the desert.

At a somewhat higher water speed, the dunes disappear and the channel bottom flattens out. Still higher velocities produce what hydraulic engineers call antidunes. More symmetrical in appearance than dunes produced by low-velocity flow, they are accompanied by waves on the stream surface—the wave crests corresponding to the antidune peaks.

Stein compared the measured bed loads at various streamflow velocities with the amount of bed load predicted by use of formulas. Preliminary results indicate that separate formulas are required to determine bed loads at low and high water speeds.

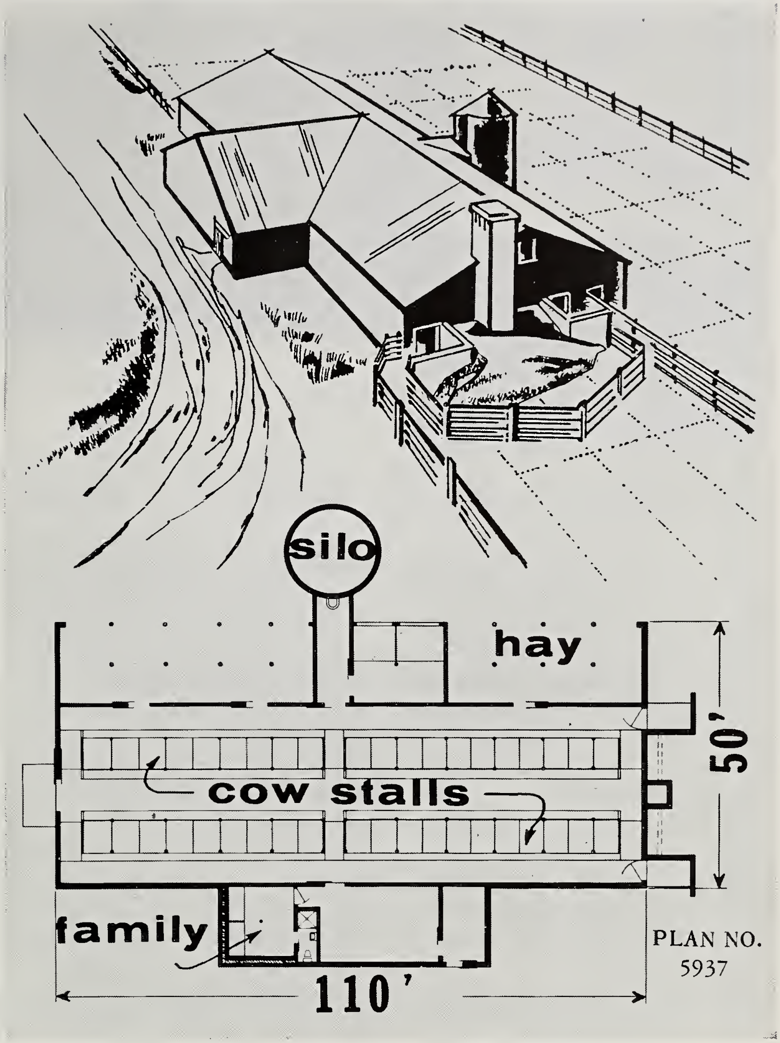
Velocity and resistance

At low-velocity flows, for example, when dunes cover the channel bed, the amount of sediment moving in continuous contact with the channel bed varies with the average velocity of the water. Under antidune conditions, caused by high-velocity flow, however, the sediment bed load varies with the resistance of the streambed to flow—called bed shear stress.

Research is continuing, to develop a single formula, incorporating both average water velocity and bed shear stress, for predicting the amount of bed load under all stream velocity conditions.☆

40 and 6

ARS designs dairy barn fallout shelter for 40 cows and family of six



Banking earth around the sides of barn will boost built-in fallout protection already provided by such features as windowless concrete walls and baffled doorways. Floor plan shows family shelter as integral part of barn.

■ A 40-cow dairy barn that includes a fallout shelter for six people and provides excellent protection for a herd in daily milk production has been designed by ARS engineers and architects at Beltsville, Md.

Because the family shelter and barn area are under the same roof, the dairyman could care for his livestock without leaving the barn, in the event of a nuclear emergency. Feed, hay, and straw are accessible from inside the barn, and the family could live on milk, if necessary.

Design details of plan No. 5937, "Dairy Barn Fallout Shelter," specify windowless masonry walls that are a foot thick and a 2-foot layer of sand above the ceiling over the stall area. Additional fallout protection is provided by feed, hay, and straw stored along one side of the barn.

The barn interior has a fallout radiation protection factor of 70 that can be increased to 110 by stacking bales of wet hay 6 feet deep against the doors. A factor of 70 means that the amount of fallout radiation in the shelter would be one-seventieth of that outdoors. The family shelter has a factor of more than 250.

The barn has its own standby generator. This unit should provide ample current to power an inside water pump, milk cooler, vacuum pump for the pipeline milker, gutter cleaner, silo unloader, water heater, and electrical hotplate for cooking.

A utility room connected to the barn houses the generator, water and vacuum pumps, and water heater. Gasoline is stored in an underground tank outside the utility room.

Fallout protection often requires construction features that do not lend themselves to the most economical operation. Since the new barn has no windows, for example, additional lighting is needed. The barn's emergency facilities are more efficient, however, than those in underground dugouts or most other emergency structures.

Working drawings of plan No. 5937 are available from extension agricultural engineers at most State agricultural colleges. There is usually a small charge.☆

Machine harvesting and pallet handling may lead to real savings of labor in harvesting burley tobacco—a job still done largely by hand.

New machine and pallets help speed . . .

TOBACCO HARVESTING

■ Tobacco harvesting, an operation that hasn't changed significantly in the last 50 years, may be in for some major labor-saving modifications.

At the University of Kentucky, Lexington, ARS and State agricultural engineers are developing a two-part system to mechanize the harvesting of burley tobacco.

Half of the system is a mechanical harvester being developed by engineers S. W. Smith of the Kentucky Agricultural Experiment Station and E. E. Yoder of ARS. The engineers predict that one man operating the machine should be able to harvest 3 acres of burley tobacco in about 10 hours—about a third of the time required in hand harvesting.

The machine takes over after the lower tobacco leaves are removed by hand. Two rotating discs cut the plants off at ground level, and two sets of chains then feed the plants into the harvester, where a metal spear pierces the lower end of each stalk. Next, the machine conveys the pierced plants to a unit that threads 6 plants, 9 inches apart, onto a wooden stick. Another conveyor moves these sticks of tobacco to a wagon pulled behind the harvester.

The other half of the new harvesting system involves the use of portable wooden frames called pallets that are carried on the wagon. Sticks of tobacco are loaded by hand into the pallets as the crop is harvested, then hauled to a clear-span, pole-type barn for curing.

In the barn, a forklift truck stacks the filled pallets two to three high.

LEFT—Agricultural engineer E. E. Yoder inspects a stick of mechanically harvested tobacco before hanging it on an experimental steel pallet. RIGHT—A pallet of tobacco is being loaded by forklift onto a wagon train for trip to the curing barn.

The pallets, which hold about 400 plants each, take about half the space required for conventional curing.

Three years of testing have shown that pallet-cured tobacco is comparable in quality to tobacco cured in a conventional curing barn.

Pallets eliminate the most dangerous and labor-consuming chore of tobacco harvesting—hanging the sticks of tobacco by hand, one stick at a time, in the rafters of the curing barn.

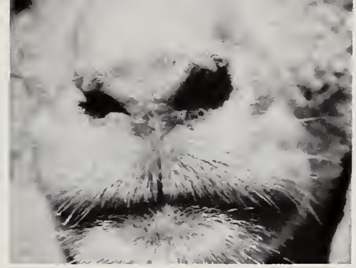
Pallet handling was pioneered by E. M. Smith, now on leave from the Kentucky station. Yoder, who is continuing the work, says this new system could also lead to improved processing of burley tobacco.

Wooden pallets have been used so far, but this year's experiments involve steel pallets, which are easier to make and should last longer.

Many tobacco farmers have very small acreages of tobacco and could not justify the expense of a mechanical harvester. However, the engineers point out, several neighboring farmers could use a mechanical harvester on a custom basis.☆

Palleted tobacco is forklifted into curing barn.

Eating wild carrot can so sensitize sheep to sunlight that exposed skin areas, like the nose, swell and ulcerate.



WILD CARROT...

Makes sheep susceptible to sunlight

■ Acute sensitivity of sheep to sunlight—resulting in painful sunburn—has been linked to the wild carrot, a highly palatable plant found on certain ranges of the West.

This sunburn disease affects up to a third of the sheep grazed on sagebrush- and juniper-covered rangeland of southeastern Colorado, southwestern Utah, northern Nevada, and southeastern Oregon. Its cause was traced to the wild carrot, *Cymopterous watsoni*, in feeding experiments by scientists of ARS and the Utah Agricultural Experiment Station at Logan.

Only unprotected areas of the sheep's body—those not normally covered with wool or that have been sheared—are affected. The disease itself is seldom fatal, but nursing ewes refuse to let their lambs touch severely sunburned and sensitive teats and udders, so that lambs under 2 weeks old often die of starvation and dehydration.

By the time the painful udder condition subsides and the ewe permits her lamb to resume nursing, milk production has fallen off or stopped. Thus, many lambs may not get enough milk to grow and develop properly.

Herders, questioned by ARS veterinarian Wayne Binns, thought that a plant known as "wild carrot," which grows in early spring, might somehow be involved. This plant is so palatable that, once sheep have grazed on it, they seem to seek it out in preference to other forage, the herders reported.

Following the herders' lead, the scientists at Logan ran feeding tests with the wild carrot. They collected plants in the early green stage during the first week in May. Then they ground the plants in the laboratory and force fed them at the rate of 113 to 454 grams per ewe once daily for 2 days. The ewes were confined in a pen exposed to direct sunshine, with alfalfa hay and water available. Ewes on the highest levels of *C. watsoni* became sunburned within 24 hours, and vesicles, ulcerations, and marked swelling followed.

The next year, similar experiments were conducted with more ewes, some of them nursing young lambs. The teats and mammary glands of all lactating ewes became severely sunburned. Milk production decreased rapidly, and ewes would not let lambs nurse.☆

Earthworms play role in . . .

Transmitting Blackhead

■ As though the problem of blackhead in turkeys and chickens weren't complicated enough, the earthworm has now crawled into the picture.

Blackhead disease is caused by a microscopic protozoan parasite, *Histomonas meleagridis,* that attacks the ceca, or blind gut, and sometimes the liver of turkeys and chickens. This parasite spends part of its life cycle in the eggs and larvae of the small eel-like cecal worm, *Heterakis gallinarum,* that is commonly found in the ceca of turkeys and chickens.

Now, scientists at the Beltsville, Md., Parasitological Laboratory, have learned that eggs of cecal worms are often eaten by two or three earthworm species. And, rather than being digested or eliminated, these eggs hatch and the larvae survive in the earthworm's body cavity. This leads to a concentration of cecal worms—and blackhead parasites—in the earthworms, which in turn are eaten readily by turkeys and chickens.

Proof that the earthworm is a true vector of blackhead came after a series of experiments conducted by ARS parasitologists E. E. Lund, E. E. Wehr, and D. J. Ellis:

1. Earthworms from contaminated poultry yards were thoroughly washed and maintained in several changes of clean soil, to remove cecal worms from their body surface and digestive tract. However, when fed to turkeys, the earthworms were still able to transmit cecal worms and blackhead.

2. Excretions collected on filter paper from contaminated earthworms failed to transmit cecal worms or blackhead. But when eaten by turkeys, these earthworms transmitted cecal worms and blackhead just as readily as earthworms obtained from contaminated soil.

3. Earthworms that were treated with dilute solutions of formalin or nitric acid for more than 16 hours failed to transmit cecal worms or blackhead. Since cecal worm eggs normally can live in these solutions for several weeks, they apparently hatched inside the earthworms and the resulting larvae were killed by the solutions.☆

Phosphorus uptake by spring wheat

Light is being shed on the relationship between soil moisture and phosphorus uptake by spring wheat plants in experiments conducted by ARS and the Montana Agricultural Experiment Station.

Soil scientists G. O. Boatwright and P. L. Brown of ARS and A. H. Ferguson of the Montana station found that spring wheat did not take up phosphorus when soil was dry in the fertilizer zone.

Their greenhouse experiments also showed that a time interval, varying

with the stage of plant maturity and soil type, elapses between wetting of the soil and phosphorus absorption. This partly explains why phosphate fertilization may not benefit Northern Great Plains wheat if rains come as small, light showers that do not keep the soil wet until the time lag is over, so uptake can begin.

The scientists first noted appreciable phosphorus uptake by plants in the tillering and early heading stages 16 hours after adding water and fertilizer to a dry Williams fine sandy loam soil. Uptake by 30-percent headed plants began after 32 hours, and uptake by fully headed plants began after 80 hours.

On Amsterdam silty clay loam soil, the time lag before phosphorus absorption began was 32 hours for tillering and early headed plants, 48 hours for 30-percent headed plants, and 122 hours for fully headed plants.

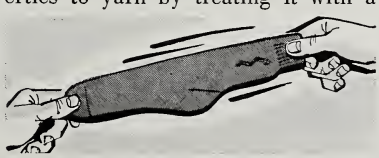
The researchers grew Thatcher spring wheat in soil columns in which a wax-impregnated cheesecloth membrane restricted upward moisture movement from the subsoil, permitting the topsoil to dry by evapotranspiration between observations. They added concentrated superphosphate fertilizer tagged with radioactive phosphorus-32. Plant samples, taken at intervals after fertilization, were analyzed for phosphorus-32 to determine uptake.

New all-cotton stretch socks

ARS scientists have developed two new methods for producing all-cotton socks, an outgrowth of the recent ARS development of stretch fabric by a process known as slack mercerization. The new socks retain their stretch properties after more than 30 wearings and launderings.

Developed by researchers M. S. Hoffman, W. G. Sloan, and A. S. Cooper, Jr., at the ARS Southern utilization research laboratory, New Orleans, the processes are expected to open up a potential new market for as much as 50,000 bales of cotton a year.

One process imparts stretch properties to yarn by treating it with a



solution of sodium hydroxide. This causes the fibers to twist and crimp, giving the yarn its stretch.

In the second process—now being adopted by industry—oversized, loosely knitted socks are made from untreated yarn. The loosely knitted socks are then treated in the chemical solution to make the fibers twist and crimp, drawing the socks up to about half their original knitted size.

Socks made by both methods cover the standard stretch range of sizes 11 to 14 and still have an additional 4 inches of stretch. Knitting was done on a variety of standard knitting machines.

Systemic drug for cattle disease

An experimental drug shows promise as a systemic treatment for trichomoniasis, a disease that can cause temporary infertility and abortion in cattle. Trichomoniasis, transmitted by bulls, is caused by a protozoan parasite, *Trichomonas foetus.*

In preliminary experiments at Beltsville, Md., dimetridazole (1,2-dimethyl-5-nitroimidazole), administered orally in capsules, has effectively eliminated *T. foetus* from the genitalia of infected bulls.

ARS parasitologist D. K. McLoughlin discovered this drug's value while screening compounds for potential trichamonacidal activity on artificially infected hamsters at the Beltsville Parasitological Laboratory.

After dimetridazole showed the most promise with hamsters, McLoughlin began experiments with bulls, the natural host of *T. foetus.*

Six bulls with long-standing infections of *T. foetus,* which had been experimentally induced, were treated daily for 5 days with 50-milligram capsules of the drug for each kilogram of body weight. Since this treatment, the bulls have been free of trichomoniasis infection—some of them for as long as 6 months.

The drug will not be recommended for trichomoniasis control until expanded experiments and field trials have been conducted and the drug has proved acceptable for registration.

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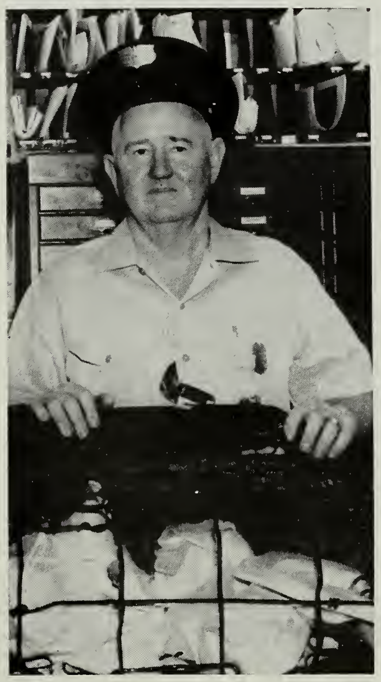
AGRISEARCH NOTES

ARS aids in major drug seizure

Instead of plant pests—heroin! The alertness of an ARS plant quarantine inspector during a routine border search has kept some 76 pounds of this deadly narcotic from reaching the illegal U.S. drug market.

In a record seizure, the heroin was removed from a "tourist" car at Laredo, Tex., this fall by ARS supervisory inspector J. E. Ragsdale and customs inspectors Hyman Scherr and P. D. Parker.

J. E. Ragsdale is shown with part of car seat containing bags of heroin he detected. This is only a fraction of the 76 pounds a couple tried to smuggle past U.S. inspectors on the Mexico border.



This is the largest seizure of heroin ever made on the Mexican border and the second largest in U.S. history. Yet it was made during a routine inspection—without advance information.

The pure heroin has an estimated value in the millions of dollars when diluted and sold on illegal markets.

Inspector Ragsdale became suspicious when he tested the car's rear seat with his knee and noticed that it was unusually hard. Search revealed 27 plastic bags of heroin jammed up under the springs. The customs inspectors completed searching the car, and removed 39 more bags of heroin that had been concealed behind its four door panels.

Officials believe continued investigation of the case may lead to information that will be valuable in efforts to halt the illegal drug traffic affecting the welfare of all Americans.

For their combined efforts in the seizure, the three inspectors have received a special group award of $2,250 and have been cited for outstanding contribution to law enforcement, the customs service, and the welfare of the people of the United States.

Advisory groups begin meetings

USDA research and marketing advisory committees are now in the midst of their annual meetings.

This year, for the first time, a portion of each meeting is being designated as a public session, at which representatives of producers, processors, distributors, and consumers are welcome to present research proposals for consideration by the committee and USDA.

Meetings still to be held will be in Washington, D.C., except as noted in the following schedule:

January: Farm Resources, 20–24, Oxford, Miss.; Oilseed, Peanut, and Sugar Crops, 27–31.

February: Grain and Forage Crops, 3–7; Horticultural Crops, 10–14; Animal and Animal Products, 17–21; Cotton and Tobacco, 24–28, at Knoxville, Tenn.

Five committees have already met—Forestry Research, Marquette, Mich., and Land O'Lakes and Rhinelander, Wis.; Utilization Research and Development, Philadelphia, Pa.; Human Nutrition and Consumer Use; Agricultural Economics; and Marketing Research and Service Programs.

This is the 17th series of annual meetings by the advisory groups, which are appointed by the Secretary of Agriculture under provisions of the Research and Marketing Act of 1946. Committees offer guidance to USDA in appraising and planning research and service programs.

This year, 11 committees are replacing last year's 23—a consolidation to better coordinate USDA research with that of other research agencies. Memberships of the 11 new committees are composed of persons appointed to the 23 committees in 1960, 1961, and 1962.

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